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AIR POLLUTION: AIR POLLUTION PILOT STUDY

NATO Committee on the Challenges of Modern Society
Brussels, Belgium

1974

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COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY

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PB 245 319

AIR POLLUTION

Final Report -- Air Pollution Pilot Study

N. 33

POLLUTION ATMOSPHERIQUE

Rapport Final -- Etude Pilote de Pollution Atmospherique

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The objective of the pilot study was to develop and enhance air quality management and dealt with the three elements most common to all national programs. They were 1) the development of air pollution assessment methodology through studies of individual cities within member countries, 2) development of air pollution criteria on the effects of major air pollutants, and 3) the technical review and publication of state-of-the-art information on control technology for major pollutants. Development of low pollution power systems was undertaken during the course of the study.

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i

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FINAL REPORT

AIR POLLUTION PILOT STUDY

A Report by the

Pilot Study Working Group

COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY

NORTH ATLANTIC TREATY ORGANIZATION

MAY 1974

PREFACE

This final report has been prepared by the Pilot Study Working Group for submission to the CCMS culminating three and one-half years of concerted and productive effort in the Air Pollution Pilot Study. The action recommendations contained herein were derived from the results of five major activities undertaken within the overall framework and objectives of the pilot study. The adoption and implementation of these recommendations will insure that the member countries of NATO have recognized the need for them to deal with this common environmental problem in a systematic and dynamic fashion.

The Working Group is composed of:

Canada	-	Dr. M. Kwizak Environment Canada
Federal Republic of Germany	-	Mr. W. Goerke Ministry of Interior
Italy	-	Professor L. Santomauro Ministry of Health
The Netherlands	-	Dr. T. Schneider National Institute of Public Health
Norway	-	Professor B. Ottar Institute of Air Research
Turkey	-	Dr. M. Miraboglu The Scientific and Technical Research Council of Turkey
United States	-	Dr. K. Jones Environmental Protection Agency

The Working Group wishes to acknowledge the contribution of those 250 scientific experts representing over 100 governmental agencies and research institutes. Additionally, we also acknowledge the encouragement and support of government officials in the contributing countries. Based on this CCMS experience, the Working Group wishes to highly endorse the pilot country concept as an excellent means of promoting international cooperation in the environmental field.

Respectfully submitted by the pilot and copilot countries:

K. H. Jones, Chairman
U.S.A., Pilot Country

H. W. Goerke
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Prof. Akif Kansu **
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AIR POLLUTION PILOT STUDY

SUMMARY

Air pollution is recognized as one of the most significant problems facing our modern industrialized society. For this reason, the CCMS undertook the Air Pollution Pilot Study as one of its charter projects at its inaugural plenary session in December 1969. The objective of the Pilot Study was to develop and enhance air quality management and dealt with the three elements most common to all national programs.

They were:

- Development of air pollution assessment methodology through studies of individual cities within member countries.
- Development of air pollution criteria on the effects of major air pollutants.
- Technical review and publication of state-of-the-art information on control technology for major pollutants.

Additionally, because of the recognized need for drastic reduction in emissions from automotive sources, development of low pollution power systems was undertaken during the course of the study.

The major efforts undertaken in the overall pilot study were divided into five areas:

- City by city air quality assessments by individual

countries, with subsequent reports to the CCMS and collaboration on publication of common assessment methodology.

- Establishment of an air quality criteria panel of experts from member countries to publish data on the effects of pollutants.
- Establishment of a control technology panel of experts from member countries to review and publish information on control measures.
- Establishment of a modeling panel of experts from member countries to assist in the development and use of models in air quality management.
- Establishment of mechanisms for cooperation on low pollution power systems development (LPPSD) through a six-nation memorandum of understanding.

The results of the Pilot Study have been completely documented in official CCMS reports listed in Appendix A.

Partial results of the Pilot Study led to the approval of the air pollution resolution by CCMS in November 1971 and its adoption by the North Atlantic Council in January 1972. The full text of the resolution is in Appendix B of this report. This resolution provided that all member nations will:

- Take cognizance of the need for dynamic efforts toward enhancing and maintaining the quality of the air;

- Endeavor to use, where appropriate for setting up national air quality management programs, the systems methodology generated by the CCMS Pilot Study; and
- Promote cooperation among members when air pollution problems are common to national boundaries.

RECOMMENDATIONS

Fifteen recommendations which directly support the above cited resolution were derived from the results of the Pilot Study. Adoption of these recommendations will demonstrate that member nations have dedicated themselves to acting on the results of this pilot effort and will move toward a dynamic and systematic solution of our common air pollution problems.

Seven recommendations are made for assessment of air quality: the first general, the second three for monitoring, and the remaining three for emissions inventory:

- RECOMMENDATION I

  Member nations will assess the air pollution in cities of 100,000 inhabitants or more and in industrial areas within their national boundaries. Member nations should establish such assessments by 1980.

- RECOMMENDATION II

  Member nations will establish effective air quality monitoring systems including the measurement of meteorological parameters.

- RECOMMENDATION III

  Member nations will employ reference methods endorsed by the World Health Organization (WHO), the Organization for Economic Cooperation and Development (OECD), and/or the International Standards Organization, or alternative methods which have been shown to be comparable to these reference methods.

- RECOMMENDATION IV

  Member nations will establish systems for monitoring data storage and retrieval such as those employed by the WHO.

- RECOMMENDATION V

  Member nations will conduct emissions inventories employing the uniform procedures based on the experience derived from the CCMS assessment studies.

- RECOMMENDATION VI

  Member nations will cooperate to develop standardized methods for emissions data storage and retrieval to support requirements in the conduct of national air quality management programs. The U.S. National Emission Data System (NEDS) might serve as a model for a common international system.

- RECOMMENDATION VII

  Member nations will cooperate to develop standardized techniques for projecting emissions and predicting future ambient air quality.

The recommendations regarding air quality criteria are:

- RECOMMENDATION VIII

  Member nations, in accordance with national priorities, will set ambient air quality standards or objectives. The criteria documents developed in CCMS and the guides and criteria developed by WHO should be used in this process.

- RECOMMENDATION IX

  Member nations will participate in the WHO program for development of criteria documents as well as in the revision of existing criteria documents.

- RECOMMENDATION X

  Member nations will support strongly national research programs and cooperate internationally for the purpose of developing additional criteria on the environmental effects of all air pollutants.

The recommendations regarding control technology are:

- RECOMMENDATION XI

  Member nations will use inter alia CCMS control

technology documents in developing plans for applying control to existing pollution sources to improve air quality.

- RECOMMENDATION XII

  Member nations will, in the course of industrial expansion, employ the best available and practicable control technology on an industry by industry basis.

- RECOMMENDATION XIII

  Member nations will assure the exchange of new information on research, development, and demonstration of the control technology. CCMS derived control technology documents should be updated periodically to reflect significant advances. The appropriate international body for this effort is the WHO International Reference Center for Air Pollution Control.

The recommendation resulting from the modeling activity is:

- RECOMMENDATION XIV

  Member nations agree that the CCMS modeling activity has shown that there is a widespread need for further international cooperation to accomplish the following tasks:

  - To continue to bring together model developers

and air quality managers for exchange of ideas, discussion of users' needs, and demonstration of modeling techniques.

- Standardize modeling techniques for specific air quality management applications and consider how computerized models might be made available for all users.
- Continue to review on-going air quality assessment studies.

The recommendation for LPPSD is:

- RECOMMENDATION XV

  Participating nations agree to take necessary actions to implement fully the memorandum of understanding, with emphasis on collaboration on the total systems approach for developing environmentally compatible motor vehicles taking into account air quality, safety, energy, and noise.

INTRODUCTION

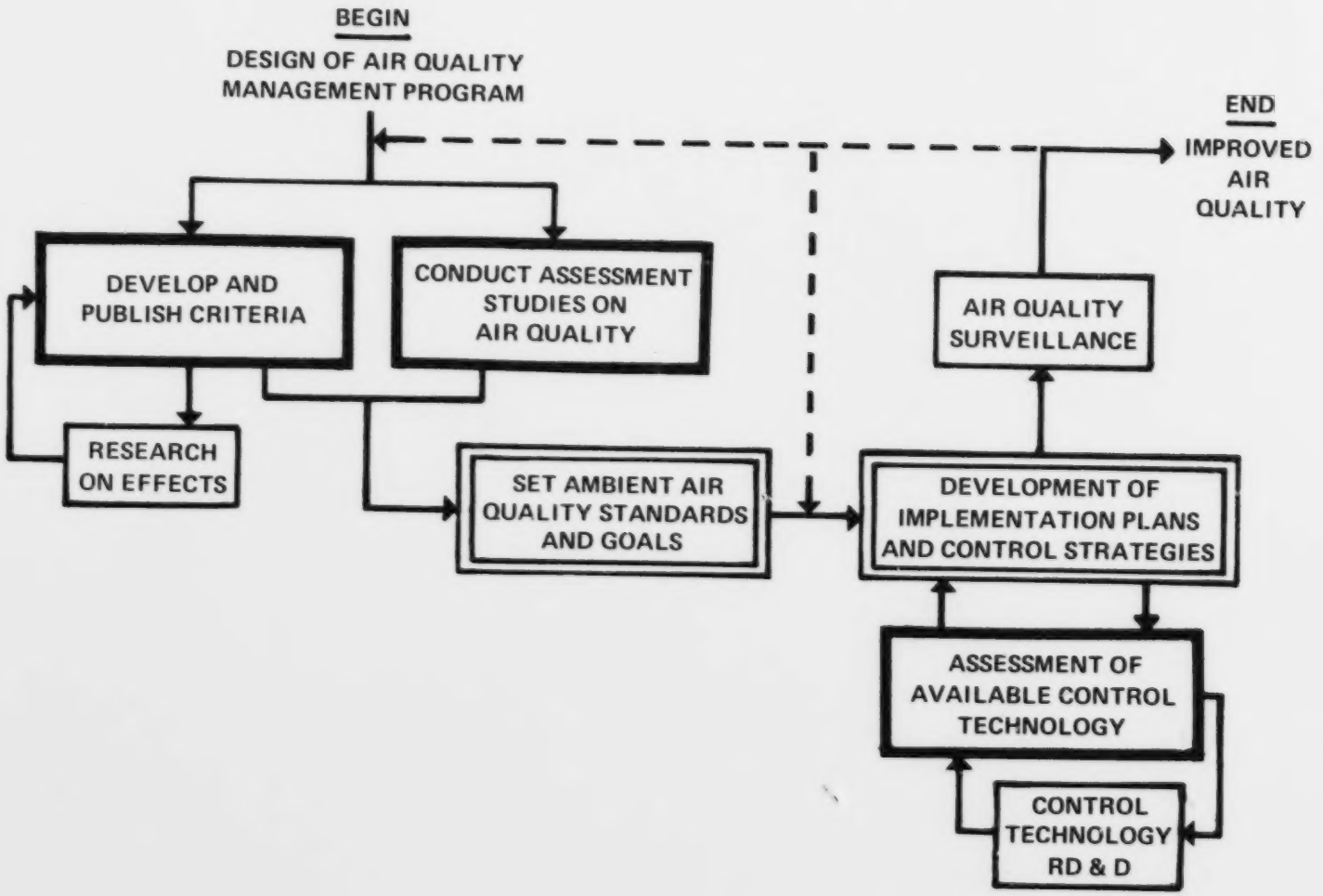
This report culminates three and one-half years of concerted effort by the participants in the air pollution pilot study initiated by the United States at the inaugural session of CCMS in December 1969. The purpose of this report is to present a brief synopsis of the accomplishments of the pilot study together with recommendations for consideration by member governments. Positive action on these recommendations will insure that member nations accept the challenge of dealing with their air pollution problems in a dynamic and systematic fashion.

The overall objective of the pilot study was to actively encourage the establishment of viable air quality management programs in member countries. Commensurate with the spirit of CCMS activities, non-NATO countries and other international organizations were invited to participate.

The pilot study was developed as an extension of a concept now known in CCMS as "The Air Quality Management System," which is shown in Figure 1. The activities undertaken and completed during the course of the study related to specific subelements of this system, in particular three elements considered common to any national program: assessment of air pollution levels in the urban environment; development of criteria regarding the environmental effects of air pollutants; and evaluation of available technology for the control of air pollutant emissions. These three subelements are emphasized in Figure 1 by the heavy outline.

FIG. 1

THE AIR QUALITY MANAGEMENT SYSTEM


BEGIN
DESIGN OF AIR QUALITY MANAGEMENT PROGRAM
END
IMPROVED AIR QUALITY
DEVELOP AND PUBLISH CRITERIA
CONDUCT ASSESSMENT STUDIES ON AIR QUALITY
AIR QUALITY SURVEILLANCE
RESEARCH ON EFFECTS
SET AMBIENT AIR QUALITY STANDARDS AND GOALS
DEVELOPMENT OF IMPLEMENTATION PLANS AND CONTROL STRATEGIES
ASSESSMENT OF AVAILABLE CONTROL TECHNOLOGY
CONTROL TECHNOLOGY RD & D

The two major elements of the system requiring institutional action within individual nations are: setting of air quality standards and development of implementation plans and control strategies to meet those standards. These elements are not considered within the purview of CCMS and therefore are not covered in this study. Two satellite research functions relating to the environmental effects and control technology, although in Figure 1, are not addressed in the pilot study, in keeping with the CCMS policy of dealing with contemporary problems using available technology.

Initial thrust of the pilot study centered around air pollution studies involving Ankara, Frankfurt, and St. Louis in which assessment methodology was to be tested, developed, and documented for widespread application. One index of how interest grew in the air pollution pilot study was the subsequent initiation of studies in Rotterdam, Oslo (two studies), Milan, Turin, and Limburg.

In addition to the ongoing assessment studies, three panels were established to carry out the other aspects of the project. The Criteria Panel was established to promulgate and publish criteria documents on six air pollutants: sulfur oxides, particulates, carbon monoxide, nitrogen oxides, and hydrocarbon/oxidants. A Control Technology Panel was established for the purpose of accumulating and publishing information on the state-of-the-art technology for controlling emissions of sulfur oxides, particulates, hydrocarbons, carbon monoxide, and nitrogen oxides from all significant stationary sources. Because of the extensive modeling employed in

the various studies, a Modeling Panel was established to act as a consolidated advisory group. This panel made recommendations regarding model design and application and assessed the modeling results.

As the pilot study progressed, it became evident that advanced technology would be required to cope with the automotive pollution problem developing in all major urban centers both inside and outside the NATO countries. Because of the long leadtime required to develop new technology, a cooperative RD&D effort was initiated, preempting the obvious recommendation which would emerge at the conclusion of the study. Six member nations signed a Memorandum of Understanding at the fall CCMS plenary of 1972 providing for strong cooperation on this important initiative.

The CCMS pilot study contributed to the rapid growth in air quality management activity in member countries over the past four years. Its value is also demonstrated by the increased number of participants in the study as well as by widespread recognition and utilization of the CCMS reports in national and international programs.

ASSESSMENT STUDIES

Air quality assessment studies form the data base from which action plans emerge for the control of air pollution:

These studies involve:

- Establishment of air pollution monitoring systems.

- Conduct of emissions inventories to determine the location and magnitude of the sources.
- Modeling of the statistical relationship between the emissions and measured air quality levels.
- Projecting of future air quality.

In addition to providing these data to air quality management institutions in the participating countries, a Guidelines Document (CCMS N.6) was compiled so that those planning similar studies will benefit from the pilot study experience. Assessment studies may be conducted using a wide spectrum of equipment and techniques, depending on financial and manpower requirements. The Guidelines Document provides a balanced study protocol within pre-set resource limitations. One can also determine what the trade-offs are in terms of accuracy and completeness of the data generated by various approaches.

The initial three city studies provided an ideal cross section of data from which to develop the Guidelines Document in terms of: the variety of techniques employed; the types of urban centers involved; and the differing levels of air pollution and source configuration. The additional five studies broaden and validate the experience gained in the first three studies.

The following is a brief resume of the eight assessment studies undertaken to date within the framework of the CCMS pilot study.

- ANKARA

Ankara is a nonindustrialized urban center located in an area susceptible to air pollution because of climatology. Use of high sulfur lignite and fuel oil causes extremely high levels of sulfur oxides and particulates. Without some modification of the fuel use policy, the projected population growth would produce an unacceptable air quality situation in the future, according to the assessment study. Although the air pollution generated by automotive traffic is only a marginal problem at present in Ankara, plans need to be made to prevent degradation of the existing conditions. The development, implementation, and completion of the Ankara study amply demonstrate what can be accomplished in terms of a comprehensive assessment study where resources are limited during the initial phases of an air quality management program. The results appear as Appendix A of the Guidelines Document.

- ST. LOUIS

The St. Louis study was conducted to support the air pollution control implementation planning exercise required by the Clean Air Act of 1967. St. Louis also represents a setting where pollution involves two jurisdictions (St. Louis, Missouri, and East St. Louis, Illinois) with the Mississippi

River lying between. The modeling results were used to determine if the short-term control strategies being imposed would maintain air quality levels over the next 20 years. This study has been published separately as Appendix B of the Guidelines Document.

- FRANKFURT

The Frankfurt air quality assessment study was initiated as one part of a comprehensive regional planning study. The goal of the regional study is to develop a plan for all forms of urban growth that will cause the least disruption to the environment or even enhance it. The meteorology of the region required that several models be developed to analyze the distribution and impact of air pollution. Several new and detailed techniques for emissions inventory and monitoring were employed in the Frankfurt study, in particular, observation of mesometeorological parameters. The complete study has been published separately as Appendix C of the Guidelines Document.

- OSLO

The first Oslo study dealt with SO_2 pollution and the effects of the unique meteorology of the area by using innovative modeling techniques. The location of the city within the Oslo Fjord creates a nonuniform wind system that does not permit using the simplified plume modeling approach. The

study results were used to examine the effects of various fuel regulations in terms of sulfur content limits. These results have been published separately as the Appendix D of the Guidelines Document.

The second Oslo study which began in March 1974 deals with the pollutants most commonly associated with mobile sources: carbon monoxide, nitrogen oxides, hydrocarbons, and lead. Of particular interest is the measurements of these pollutants in the streets of Oslo. It is anticipated that the results of this study will be reported to CCMS within the next year.

- ROTTERDAM

The Rotterdam air quality assessment is a three-year study dealing with the impact of a large industrialized complex and a major city with a large port facility. The study is focused on photochemical oxidants and the precursors that cause their occurrence. The hydrocarbons are emitted by the refineries and petrochemical facilities in the industrialized complex, as well as by the region's road traffic. The study is divided into three phases: establishment of a monitoring system to assess air quality and to study features of smog episodes; emissions inventory of industry, road, and water traffic and space heating; and studying the applicability

of control measures and the results thereof. The report on phase 1 of this study is planned for publication as Appendix E to the Guidelines Document.

- MILAN

A comprehensive study of the residential industrial region of Milan, Italy, has been underway for the past three years. It has focused on the assessment and control of sulfur dioxide pollution. Because of the relatively flat terrain, modeling is proving to be a useful tool for linking pollutant emission sources to air quality levels under various meteorological conditions. This study will be published as Appendix F to the Guidelines Document.

- TURIN

In November of 1973, a special study dealing with the impact of carbon monoxide along Turin streets was initiated by FIAT and the Italian health authorities. New techniques are being employed to determine actual vehicle density and operating cycles on the street systems. The development of typical transportation patterns relating to automobiles, trucks, buses, etc., is yet to be resolved to complete satisfaction in any country, emphasizing the importance of the Turin study. When the study is completed in 1975, the results will be reported as Appendix G to the Guidelines Document.

- LIMBURG

  Recently Netherlands officials announced the initiation of an air pollution study in the Province of Limburg. This study will focus on the development of a detailed nation-wide emissions inventory using the Province as a pilot area. This first phase is to be completed by the fall of 1974. The results will be transmitted to CCMS for distribution to member countries.

AIR QUALITY CRITERIA

The Criteria Panel met on three occasions to draft the criteria documents on sulfur oxides (CCMS N.7), particulates (CCMS N.8), carbon monoxide (CCMS N.10), nitrogen oxides (CCMS N.15), and oxidants/hydrocarbons (CCMS N.29). The meetings were held in Bonn, Federal Republic of Germany (February 1972), Bilthoven, The Netherlands (June 1972), and Istanbul, Turkey (April 1973).

Representatives from eight NATO countries and Israel participated in one or more of the meetings. The promulgation and publication of internationally recognized criteria documents on the environmental effects of air pollutants are absolutely necessary if national air quality programs in member countries are to proceed in a timely and uniform manner. The use of common criteria will assist nations in setting air quality goals or standards regardless of whether they have generated their own independent data base. These goals or standards should be set considering each country's ability to allocate resources commensurate

with the environmental risk involved. Here, two approaches are available. One is to set air quality goals and interim standards for achievement on a fixed timetable based on available and projected air pollution control resources. The second approach is to set specific standards and develop the timetable to achieve the standards. The first approach, probably the stricter of the two options, depends upon the rigidity of institutional arrangements established in each country for controlling pollution. It should be recognized that criteria generally point to air pollution levels which will be accepted as standard in time by most national authorities. Further, as new information is gathered concerning the lower limit effects of a given pollutant, a downward shift in the standards will probably be indicated.

The criteria contained in the documents on sulfur oxides, particulates, and carbon monoxide were used as references in the establishment of air quality guides and goals by the World Health Organization. The WHO has established a program to collate, review, and publish additional information on the pollutants already documented by CCMS, as well as on other pollutants. It is important that such programs be given full support by all nations so that guidelines for standard setting on all significant pollutants may be established within a reasonable timeframe.

CONTROL TECHNOLOGY

The Control Technology Panel prepared state-of-the-art documents on control methods for emissions from all significant stationary sources

of five pollutants: sulfur oxides (CCMS N.12), particulates (CCMS N.13), carbon monoxide (CCMS N.18), hydrocarbons (CCMS N.19), and nitrogen oxides (CCMS N.20). Mobile source emissions were not included because emissions standards have been established within the various member countries and current technology is being employed. The member countries contributing to the activities of the panel were the Federal Republic of Germany, Denmark, France, Italy, Turkey, and the United States.

The control technology documents provide a basic reference to be used during the development of implementation plans for the abatement of stationary source emissions. These documents should also be consulted when new industry is being established or old industry is being replaced in terms of preventing air quality degradation. The use of common control technology also overcomes economic problems which might occur when countries employ control technologies of differing degrees of effectiveness and cost.

Because of the dynamic nature of current research and development in the field of air pollution control technology, means should be sought to insure the rapid international dissemination of new research information. The international documentation and distribution of such information should be a continuing function undertaken by an appropriate international body.

MODELING

The Modeling Panel was established to give expert advice on model

design and applications in the assessment studies undertaken in the pilot study. Additionally, the group acted as a forum for the exchange of new information and ideas on the science of air pollution modeling. During the study, panel meetings were held in Frankfurt (October 1970), Paris (July 1971 and October 1972), Oberursel, Federal Republic of Germany (May 1973), and Roskilde, Denmark (June 1974). Technical reports CCMS N.5, N.14, N.30, and N.35, were published on the results of the panel's activity; 56 scientists from 10 NATO and 3 non-NATO countries have participated. This panel has become a dynamic international forum on the subject of air quality modeling.

It has been apparent that a communication gap exists between the designers of models and the air quality managers. At the June 1973 panel meeting, the panel agreed to continue to function beyond the official termination date of the pilot study. As part of this new activity, the panel will bring modelers and users together in a workshop forum designed to:

- Expand the use of models in the air quality management decision process.
- Insure that models are properly validated and applied in air quality management.
- Improve the designer's and user's understanding of each others requirements in the development and application of models.

LOW POLLUTION POWER SYSTEMS DEVELOPMENT

Recognizing the need for both the short- and long-term development of low pollution power systems, the U.S., as pilot country, introduced the Low Pollution Power Systems Development (LPPSD) initiative in November 1970. A conference was held February 1971 in Eindhoven, The Netherlands, to start NATO-wide cooperation in this field. A Memorandum of Understanding (MOU) was signed in November 1972 by France, Federal Republic of Germany, Italy, The Netherlands, the United Kingdom, and the United States. Sweden has indicated a strong interest in participating in this program. The MOU provides for:

- Direct exchange of technical information among the participants.
- Annual technical symposia.
- Direct collaboration on specific research and development projects.

A second symposium was held in Ann Arbor, Michigan, in October 1973; 37 delegates from the MOU countries and Sweden attended. Total attendance was over 300. An Annex to the MOU was signed formally establishing mechanisms for technical information exchange. The text of the MOU and the Annex are published in Appendices C and D. Several conclusions emerged from this second conference that should more clearly define the future course of the LPPSD initiative:

- The symposium proved to be an ideal mechanism for interfacing government and industry programs within

the participating countries, and such symposia should continue on an annual basis in accord with the MOU. The next symposium will be held in Dusseldorf in November 1974.

- The automobile must be looked upon as a total system with respect to its utility and impact upon the environment. Factors other than emission control--for example, safety, energy, and noise--should be explored to integrate the LPPSD and Experimental Safety Vehicle programs within CCMS. As a first step, the two programs plan to hold their annual symposia jointly in 1975.
- A clear-cut need emerged for technical criteria to guide future development of automotive power systems. Such criteria will allow more effective cooperation among the program participants, as well as provide a rational basis for comparing research and development results. Although a single set of specifications is obviously not possible or desirable, a need exists to coalesce thinking on such factors as vehicle weight, driving cycles, fuel economy, and noise design criteria. The U.S. agreed to develop a preliminary set of criteria for circulation to the other participating governments for comments and revision. Followup action may involve establishment of an ad hoc working group to finalize a set of LPPSD criteria.
- Benefits from government research can be maximized through

close cooperation among governments in the LPPSD field, and the participating governments urged direct collaboration on future projects.

**On March 25, 1975, the Government of Turkey requested minor changes in the text of Recommendations I and XI. The proposed changes were not received prior to the date of publication. However, this report, as printed, was approved by the North Atlantic Council on September 11, 1974.

APPENDIX A

LIST OF DOCUMENTS

NATO/CCMS AIR POLLUTION PUBLICATIONS

Technical Report on the Conference on Low Pollution Power Systems Development, N.4

Proceedings of the Second Meeting of the Expert Panel on Air Pollution Modeling, N.5

Guidelines to Assessment of Air Quality (Revised) SO_x, TSP, CO, HC, NO_x and Oxidants, N.6*

- Appendix A - Assessment of Air Quality in Ankara, Turkey
- Appendix B - Assessment of Air Quality in St. Louis, Missouri United States
- Appendix C - Assessment of Air Quality in Frankfurt, Federal Republic of Germany
- Appendix D - Assessment of Air Ouality in Oslo, Norway
- Appendix E - Assessment of Air Quality in Rotterdam, The Netherlands+
- Appendix F - Assessment of Air Quality in Milan, Italy+
- Appendix G - Assessment of Air Quality in Turin, Italy+

Air Quality Criteria for Sulfur Oxides, N.7*

Air Quality Criteria for Particulate Matter, N.8*

Air Quality Criteria for Carbon Monoxide, N.10*

Control Techniques for Sulfur Oxide Air Pollutants, N.12*

Control Techniques for Particulate Air Pollutants, N.13*

Proceedings of the Third Meeting of the Expert Panel on Air Pollution Modeling, N.14

Air Quality Criteria for Nitrogen Oxides N.15*

Control Techniques for Carbon Monoxide Emissions from Stationary Sources, N.18*

Control Techniques for Hydrocarbons and Organic Solvent Emissions from Stationary Sources, N.19*

Control Techniques for Nitrogen Oxide Emissions from Stationary Sources, N.20*

Air Quality Criteria for Photochemical Oxidants and Related Hydrocarbons, N.29*

Proceedings of the Fourth Meeting of the Expert Panel on Air Pollution Modeling, N.30

Symposium on Low Pollution Power Systems Development, October 1973, Ann Arbor, Michigan, USA, N.32

Final Report--Air Pollution Pilot Study, N.33*

Proceedings of the Fifth Meeting of the Expert Panel on Air Pollution Modeling, N.35

Symposium on Low Pollution Power Systems Development, November 1974, Dusseldorf, Federal Republic of Germany, N.39

*Also available in French

+To be published

APPENDIX B

RESOLUTION

RESOLUTION

It has been recognized that air pollution is one of our major environmental issues which requires resolution by the members of the NATO Community, as well as others, on an individual and collective basis. The results of the three assessment studies reinforce the concept of utilizing a comprehensive systems approach for air quality management. The evaluation of the impact has been delineated in the guidelines document and has been verified through application by the pilot and copilot countries. The criteria documents on sulfur oxides and particulates provide the scientific basis against which the impact on health and welfare for existing and future conditions can be assessed. The control technology documents, when completed, will allow for the rational development of control strategies for alleviating the near-term problems as well as projected future needs.

Based on the availability of those tools for development of long-term air quality management strategies, be it resolved that all member nations will:

(1) Take cognizance of the need for dynamic efforts toward enhancing and maintaining the quality of the air;

(2) Endeavor to use, where appropriate for setting up national air quality management programs, the systems methodology generated by the CCMS pilot study; and

(3) Promote cooperation among members when air pollution problems are common to national boundaries.

APPENDIX C

LPPSD

MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING ON THE DEVELOPMENT
OF LOW POLLUTION POWER SYSTEMS FOR MOTOR VEHICLES

1. This multilateral Memorandum of Understanding is concluded, following an exchange of views which took place within the Committee on the Challenges of Modern Society of the North Atlantic Council, between the following agencies:

a. The Federal Ministry of the Interior of the Federal Republic of Germany;

b. The Institute of Transport Research of France;

c. The Ministry of Transport of Italy;

d. The Ministry of Transport and Waterways of The Netherlands;

e. The Department of the Environment of the United Kingdom;

f. The Environmental Protection Agency of the United States of America;

The aim of this Memorandum is to encourage the development and testing of low pollution power systems for motor vehicles (which encompass new types of engines or advanced control systems for the internal combustion engine) in the interest of the health and well being of our peoples. The signatories to this Memorandum of Understanding will cooperate freely with each other and with other countries and international organizations with similar goals and programs so as to ensure that the total resources available internationally for developing and bringing into use vehicles with low pollution power systems are deployed to the best advantage.

2. There are, in the countries of the signatories to this Memorandum of Understanding, governmental and/or industrially sponsored programs which collectively form a broad based attack on a challenging technological

problem facing our society. Believing that international cooperation in the field of motor vehicle pollution control will prove fruitful for all signatories, the signatories will undertake a comprehensive exchange of knowledge gained about the design, the technical characteristics and the performance of low pollution power systems in the course of the conduct and monitoring of development activities within their respective countries, insofar as such information is at their disposal for publication, in as timely and detailed a manner as is possible under their respective statutes. Additionally they will participate in technical symposia, expected to be held at least annually, for the review of research and development programs, discussions and exchange of information and ideas.

3. When two or more parties to this Memorandum of Understanding wish to develop more specific relationships on subprograms or projects within the fields of this Memorandum of Understanding, details of any agreement, arrangement or accord between them may be annexed to this Memorandum of Understanding.

4. The procedures to be used to implement this cooperative program will be developed among the signatories with the Environmental Protection Agency of the United States of America acting as the coordinating agency.

5. This Memorandum of Understanding is open to subsequent participation by the relevant governmental department or agency of other countries subject to the agreement of existing signatories.

6. This Memorandum of Understanding shall come into operation for each signatory on the date of its signature thereof and will remain in operation indefinitely in respect of all signatories which have not notified the termination of their participation by 30 days notice in writing.

DONE NOVEMBER 14, 1972, AT BRUSSELS:

UNITED STATES OF AMERICA

FRANCE

FEDERAL REPUBLIC OF GERMANY

ITALY

THE NETHERLANDS

UNITED KINGDOM

APPENDIX D

LPPSD

ANNEX TO MOU

ANNEX TO MEMORANDUM OF UNDERSTANDING ON LOW POLLUTION POWER SYSTEMS DEVELOPMENT CONCERNING EXCHANGE OF TECHNICAL INFORMATION

I. On November 14, 1972, a Memorandum of Understanding concerning Low Pollution Power Systems Development (LPPSD) was concluded between the appropriate agencies of the following nations: the Federal Republic of Germany, France, Italy, the Netherlands, the United Kingdom, and the United States, hereafter referred to as the "participants" to this agreement. This Memorandum included provisions for technical symposia, technical information exchange, and collaborative projects. This annex is designed to provide a timely, orderly, and efficient means of exchanging technical information on research, development, and testing of low polluting power systems among all of the participants in the Memorandum, so that each participant might keep abreast of parallel LPPSD developments in other countries party to the Memorandum.

II. Technical information on LPPSD shall be made available on a voluntary basis as described below:

(a) Any information made available under this annex will be made available simultaneously to all participants in the Memorandum by direct transmission to a contact to be named for each participant.

(b) Information exchanged may include (to the extent that the laws of the respective participants allow), but not be limited to:

1. General information of each participant's current LPPSD programmes, including their objectives, results, funding levels, etc.

2. Interim reports on LPPSD progress.

3. Final project reports.

4. Results of bilateral or multi-lateral collaborative projects undertaken under the Memorandum.

5. Reports issued as a result of technical symposia. In this regard the report on the annual LPPSD Conference will constitute the annual report to the Committee on the Challenges of Modern Society on the progress made in LPPSD.

6. Other technical information likely to be of interest to the participants.

(c) Each participating state may provide information in its native language only.

(d) Proprietary information identified as such by the source shall be released only to those participants or persons specified by the source, or to whom release is subsequently authorized by the original source.

III. Any participant may terminate his participation in the program envisaged in this annex at any time by informing all remaining participants of his intention to do so.

IV. Changes may be made to this annex at any time subject to the approval by all participants.

V. This annex takes effect from the date of its signing by authorized representatives of all participants, and shall remain in operation indefinitely unless terminated with the consent of the participants.

DONE OCTOBER 19, 1973, AT ANN ARBOR, MICHIGAN:

UNITED STATES OF AMERICA

FRANCE

FEDERAL REPUBLIC OF GERMANY

ITALY

THE NETHERLANDS

UNITED KINGDOM

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